

What is claimed is:

1 1. A collective detection method for wavelength
2 fluctuations of signals for use in a wavelength division
3 multiplexing optical communication system including:
4 a step of photoelectrically converting wavelength
5 division multiplexed transmission lights consisting of signal
6 lights of a plurality of wavelengths having undergone
7 modulation with mutually different frequencies after causing
8 the lights to be transmitted by optical filters having a
9 plurality of wavelength pass bands, and causing said
10 photoelectrically converted electrical signals to be
11 transmitted by first band pass filters the pass band of each
12 of which is said modulation frequency; and a step of detecting
13 the output level of the pass band of each of said first band
14 pass filters and thereby detecting any fluctuation in each of
15 the wavelengths said wavelength division multiplexed
16 transmission lights contain.

1 2. The collective detection method for wavelength
2 fluctuations, as claimed in Claim 1, further including:
3 a step of branching part of said wavelength division
4 multiplexed transmission lights, photoelectrically
5 converting the branched lights and causing said
6 photoelectrically converted electrical signals to be
7 transmitted by second band pass filters having the same
8 characteristics as said first band pass filters; and
9 a step of dividing, before detecting the output level of the
10 pass band of each of said first band pass filters, the output

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11 level of the pass bands of said first band pass filters by the
12 output levels of the pass bands of the respectively matching
13 ones of said second band pass filters.

1 3. The collective detection method for wavelength
2 fluctuations, as claimed in Claim 1, wherein:

3 the wavelength of each of said signal lights is initially
4 set in a wavelength band between the pass band and the stop
5 band of said optical filter before said detection of wavelength
6 fluctuations is started.

1 4. The collective detection method for wavelength
2 fluctuations, as claimed in Claim 1, wherein:

3 the wavelength band between the pass band and the stop
4 band of said optical filter is so set as to include the
5 wavelength of each of said signal lights before said detection
6 of wavelength fluctuations is started.

1 5. A collective detection system for wavelength
2 fluctuations for use in a wavelength division multiplexing
3 optical communication system is provided with:

4 an optical filtering means having a plurality of
5 wavelength pass bands for transmitting wavelength division
6 multiplexed transmission lights consisting of a plurality of
7 signal lights having undergone modulation with mutually
8 different frequencies;

9 a means for collectively receiving and
10 photoelectrically converting the lights transmitted by said

11 optical filtering means;
12 first band pass filtering means each having as its pass
13 band said modulation frequency of each of said
14 photoelectrically converted electrical signals; and
15 a means for detecting the output level of the pass band
16 of each of said band pass filtering means and detecting any
17 fluctuation in each of the wavelengths said wavelength division
18 multiplexed transmission lights contain.

1 6. The collective detection system for wavelength
2 fluctuations, as claimed in Claim 5, further provided with:
3 second band pass filtering means having the same
4 characteristics as said first band pass filtering means for
5 branching part of said wavelength division multiplexed
6 transmission lights, photoelectrically converting the
7 branched lights and transmitting said photoelectrically
8 converted electrical signals; and
9 a means for dividing, before detecting the output level
10 of the pass band of each of said first band pass filters, the
11 output level of the pass bands of said first band pass filters
12 by the output levels of the pass bands of the respectively
13 matching ones of said second band pass filters.

1 7. The collective detection system for wavelength
2 fluctuations, as claimed in Claim 5, wherein:
3 the wavelength of each of said signal lights is initially
4 set in a wavelength band between the pass band and the stop
5 band of the optical filtering means before said detection of

6 wavelength fluctuations is started.

1 8. The collective detection system for wavelength
2 fluctuations, as claimed in Claim 5, wherein:

3 a wavelength band between the pass band and the stop band
4 of said optical filtering means is so set as to include the
5 wavelength of each of said signal lights before said detection
6 of wavelength fluctuations is started.

1 9. The collective detection system for wavelength
2 fluctuations, as claimed in Claim 5, wherein:

3 said band pass filtering means consists of a plurality
4 of band pass filters arranged in parallel.

1 10. The collective detection system for wavelength
2 fluctuations, as claimed in Claim 5, wherein:

3 said band pass filtering means are provided with:
4 a means for digitally converting the output signals of
5 said photoelectric conversion means and
6 a signal processing means having a digital filtering
7 function.

1 11. A wavelength division multiplexing optical
2 transmission apparatus for stabilizing wavelengths by feeding
3 back outputs of detection of wavelength fluctuations provided
4 with:

5 a plurality of optical transmission means each
6 comprising a semiconductor laser for oscillating signal lights

7 having different wavelengths and modulated with different
8 frequencies and a temperature controller for controlling the
9 temperature of said semiconductor laser;

10 a wavelength division multiplexing means for
11 multiplexing said plurality of signal lights into wavelength
12 division multiplexed transmission lights and sending them out;

13 a means for branching part of said wavelength division
14 multiplexed transmission lights;

15 an optical filtering means having a plurality of pass
16 bands and transmitting the branched component of said
17 wavelength division multiplexed transmission lights;

18 a means for collectively receiving and
19 photoelectrically converting the lights transmitted by said
20 optical filtering means; and

21 first band pass filtering means having as their
22 respective pass bands said photoelectrically converted
23 electrical signals, and each supplying the output of the pass
24 band to said temperature controller for controlling the
25 temperature of said semiconductor laser modulated with the
26 matching frequency, wherein:

27 each of said temperature controllers controls the
28 temperature of the matching one of said semiconductor lasers
29 so as to keep the outputs of said first band pass filtering
30 means at a prescribed level and thereby stabilizes each of the
31 wavelengths said wavelength division multiplexed transmission
32 lights contain.

1 12. The wavelength division multiplexing optical

2 transmission apparatus, as claimed in Claim 11, further
3 provided with:

4 second band pass filtering means, having the same
5 characteristics as said first band pass filtering means, for
6 further branching and photoelectrically converting part of
7 said wavelength division multiplexed transmission lights and
8 transmitting photoelectrically converted electrical signals;

9 and

10 a means for dividing, before supplying the outputs of
11 the pass band of each of said first band pass filtering means
12 to said temperature controllers, the output levels of the pass
13 bands of said first band pass filtering means by the output
14 levels of the pass bands of the respectively matching ones of
15 said second band pass filtering means.

1 13. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 11, wherein:

3 the wavelength of each of said signal lights is initially
4 set in a wavelength band between the pass band and the stop
5 band of said optical filtering means before said detection of
6 wavelength fluctuations is started.

1 14. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 11, wherein:

3 a wavelength band between the pass band and the stop band
4 of said optical filtering means is so set as to include the
5 wavelength of each of said signal lights before said detection
6 of wavelength fluctuations is started.

1 15. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 11, wherein:
3 said band pass filtering means consist of a plurality
4 of electrical band pass filters arranged in parallel.

1 16. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 11, wherein:
3 said band pass filtering means are provided with:
4 means for digitally converting the output signals of said
5 photoelectric conversion means and
6 signal processing means having a digital filtering
7 function.

1 17. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 11, wherein:
3 said optical filtering means are arrayed waveguide
4 grating (AWG) type spectral elements.

1 18. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 11, wherein:
3 fiber Bragg grating (FBG) type spectral elements.

1 19. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 11, wherein:
3 said optical filtering means are Fabry-Perot etalon type
4 spectral elements.

1 20. A wavelength division multiplexing optical
2 transmission apparatus for stabilizing wavelengths by feeding
3 back outputs of detection of wavelength fluctuations provided
4 with:

5 a plurality of optical transmission means each
6 comprising a semiconductor laser for oscillating signal lights
7 having different wavelengths and modulated with different
8 frequencies and a temperature controller for controlling the
9 temperature of said semiconductor laser;

10 a wavelength division multiplexing means for
11 multiplexing said plurality of signal lights into wavelength
12 division multiplexed transmission lights and sending them out;

13 a means for branching part of said wavelength division
14 multiplexed transmission lights;

15 an optical filtering means having a plurality of pass
16 bands and transmitting the branched component of said
17 wavelength division multiplexed transmission lights;

18 a means for collectively receiving and
19 photoelectrically converting the lights transmitted by said
20 optical filtering means; and

21 first band pass filtering means having as their
22 respective pass bands said photoelectrically converted
23 electrical signals, and each supplying the output of the pass
24 band to said temperature controller for controlling the
25 temperature of said semiconductor laser modulated with the
26 matching frequency, wherein:

27 each of said temperature controllers causes the
28 temperature of the matching one of said semiconductor lasers

29 to fluctuate at a low frequency and controls the temperature
30 of said semiconductor laser so as to minimize said low frequency
31 outputs of said first band pass filtering means and thereby
32 stabilizes each of the wavelengths said wavelength division
33 multiplexed transmission lights contain.

1 21. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 20, further
3 provided with:

4 second band pass filtering means, having the same
5 characteristics as said first band pass filtering means, for
6 further branching and photoelectrically converting part of
7 said wavelength division multiplexed transmission lights and
8 transmitting photoelectrically converted electrical signals;
9 and

10 a means for dividing, before supplying the outputs of
11 the pass band of each of said first band pass filtering means
12 to said temperature controllers, the output levels of the pass
13 bands of said first band pass filtering means by the output
14 levels of the pass bands of the respectively matching ones of
15 said second band pass filtering means.

1 22. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 20, wherein:

3 the wavelength of each of said signal lights is initially
4 set in the pass band of said optical filtering means before
5 said detection of wavelength fluctuations is started.

1 23. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 20, wherein:
3 the pass band of said optical filtering means is so set
4 as to include the wavelength of each of said signal lights
5 before said detection of wavelength fluctuations is started.

1 24. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 20, wherein:
3 said band pass filtering means consist of a plurality
4 of electrical band pass filters arranged in parallel.

1 25. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 20, wherein:
3 said band pass filtering means are provided with:
4 means for digitally converting the output signals of said
5 photoelectric conversion means and
6 signal processing means having a digital filtering
7 function.

1 26. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 20, wherein:
3 said optical filtering means are arrayed waveguide
4 grating (AWG) type spectral elements.

1 27. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 20, wherein:
3 fiber Bragg grating (FBG) type spectral elements.

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1 28. The wavelength division multiplexing optical
2 transmission apparatus, as claimed in Claim 20, wherein:
3 said optical filtering means are Fabry-Perot etalon type
4 spectral elements.